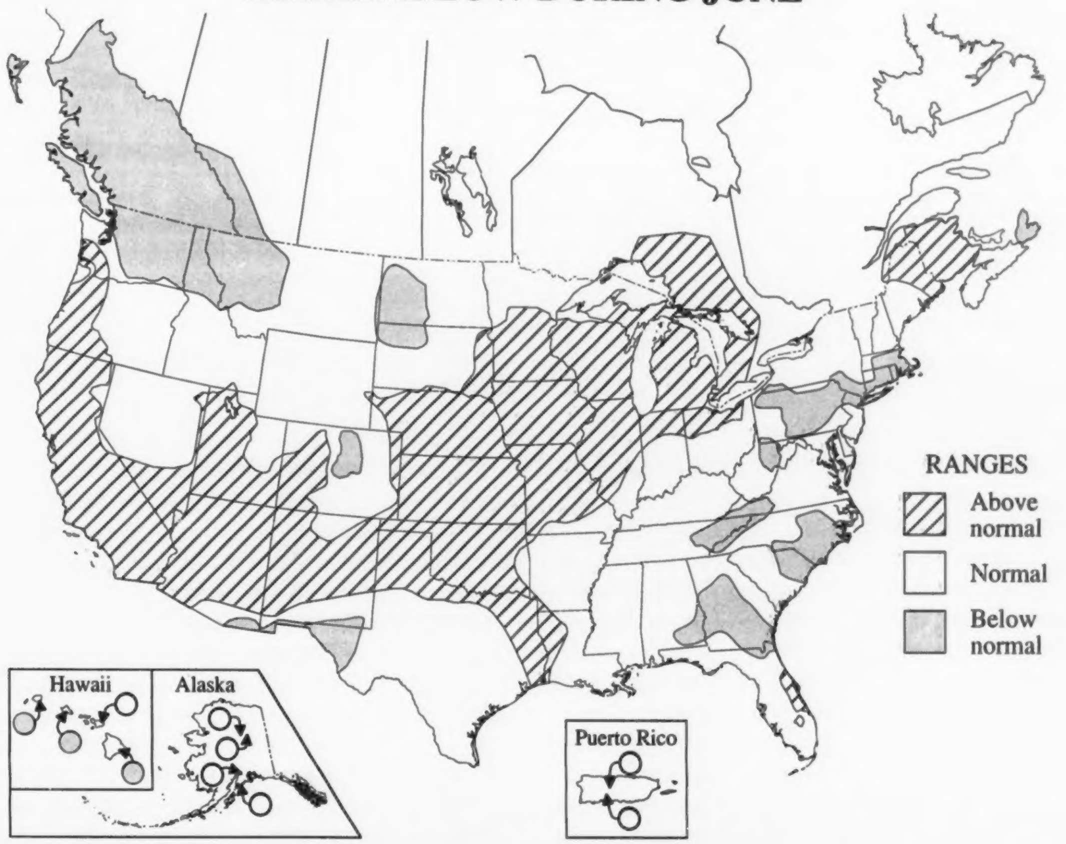
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

JUNE 1993

STREAMFLOW DURING JUNE



The persistent wet-weather pattern throughout the upper Midwestern United States continued during June. Clusters of intense thunderstorms spawned many tornadoes—more than a dozen in South Dakota on Monday, June 7 and 47 on Tuesday, June 8, of which 18 were in Wisconsin. Flooding occurred June 7 in parts of the southern and southwestern suburbs of Chicago, Illinois. Three expressways were closed and the Calumet leg of the Deep Chicago Tunnel, which is used for flood control, filled with rainwater for the first time. On the evening of June 12, as much as 6 inches of rain fell on the saturated soils of northwestern Iowa. By mid-month, the upper Mississippi River and its tributaries, which were already near bankfull, surged above flood stage.

During June 17-18, 2 to 7 inches of rain fell throughout southern Minnesota, northern Iowa, and southwestern Wisconsin. Runoff from this storm alone caused flooding in the Minnesota and Mississippi Rivers in Minnesota and the Chippewa and Black Rivers in Wisconsin. Over 3 inches of rain fell June 19 in localized areas in Wisconsin where flooding by Sunday, June 20, damaged Arbutus Dam on the Black River near Hatfield.

Peak discharges for the 1993 flood during June occurred at station Minnesota River near Jordan, Minnesota, on June 25 and station Mississippi River at St. Paul, Minnesota, on June 26. The broad, flat crest on the Mississippi River reached northeastern Iowa by the end of June. The Mississippi was closed to all barge traffic on June 28 between St. Paul and St. Louis, Missouri. The combined flow of the three largest rivers in the lower 48 States—the Mississippi, St. Lawrence, and Columbia Rivers—continued above average in June.

In northwestern Iowa, the Spirit Lake pool elevation reached the 100-year recurrence level. In central Iowa, a record pool elevation of 889.36 feet was established on June 14 in Saylorville Reservoir. In east-central Iowa, the water level in Coralville Reservoir was within 0.5 foot of the top of the emergency spillway.

Mean June elevations at the four master gages on the Great Lakes (National Ocean Service provisional data) remained in the normal range on Lakes Superior and Huron and in the above-normal range on Lakes Erie and Ontario.

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SURFACE-WATER CONDITIONS DURING JUNE 1993

The persistent wet-weather pattern throughout the upper Midwestern United States continued during June. Clusters of intense thunderstorms spawned many tornadoes—more than a dozen in South Dakota on Monday, June 7 and 47 on Tuesday, June 8, of which 18 were in Wisconsin. Flooding occurred June 7 in parts of the southern and southwestern suburbs of Chicago, Illinois. The greatest rainfall measured was 4.6 inches in 2 hours at Burr Ridge, Illinois. On Sawmill Creek near Lemont (about 8 miles west of Chicago and on the south side of Argonne National Laboratory), the June 7 peak discharge of 1,800 cubic feet per second (cfs) was almost twice that of the previous record and about 10 percent more than the 100-year flood. Flooding caused the shutdown of three Chicago expressways. The 9.1-mile long Calumet leg of the Deep Chicago Tunnel used for flood control filled with rainwater for the first time. At O'Hare Airport, 250 inbound and outbound flights were canceled. On the evening of June 12, as much as 6 inches of rain fell on the saturated soils of northwestern Iowa. By mid-month, the upper Mississippi River and its tributaries, which were already near bankfull, surged above flood stage.

During June 17-18, 2 to 7 inches of rain fell throughout southern Minnesota, northern Iowa, and southwestern Wisconsin. Runoff from this storm alone caused flooding in the Minnesota and Mississippi Rivers in Minnesota and the Chippewa and Black Rivers in Wisconsin. Flooding occurred in central Wisconsin as a result of intense rains that began on June 19. Over 3 inches of rain fell in localized areas after previous daily rains and wet antecedent conditions. Over 700 people were evacuated in Jackson and Clark Counties and the two counties have been declared in a state of emergency by the Governor. Interstate 94 was closed for 7 hours on Sunday, June 20 near the Black River. Lake Arbutus Dam on the Black River near Hatfield was damaged during the flood and was in danger of failing. The lake has been drawn down because of piping and erosion at the dam, but still poses a threat if there is additional major rainfall. No new peaks of record occurred, but the June 21 peak discharge of the Black River near Galesville equalled that of the 100-year flood.

A sampling of June rainfall records includes nearly 12 inches at Rockford and more than 13 inches at Moline in Illinois, and more than 10 inches at Waterloo, Iowa. In Iowa, the first week of June was the wettest week of the year, above-normal precipitation fell for the 8th consecutive month, and the November-through-June period was the wettest (over 27 inches) ever recorded since State records began in 1873. In Wisconsin, June precipitation recorded at La Crosse (7.5 inches) was the fifth highest for any month in this century.

Heavy rains over most of southern Minnesota caused

Provisional data; subject to revision

NEW MAXIMUMS DURING JUNE 1993 AT STREAMFLOW INDEX STATIONS

Station number	Stream and place of determination	Drainage area (square miles)	Previous June maximums (period of record): Years of record	Previous June maximums: Monthly mean in cfs (year)	Previous June maximums: Daily mean in cfs (year)	June 1993: Monthly mean in cfs	June 1993: Percent of median	June 1993: Daily mean in cfs	June 1993: Day
04071000	Oconto River near Gillett, Wisconsin	705	81	1,744 (1916)	3,170 (1969)	1,766	263	3,271	22
04084500	Fox River at Rapide Croche Dam near Wrightstown, Wisconsin	6,010	96	13,150 (1942)	21,300 (1943)	13,300	355	16,530	18
04264331	St. Lawrence River at Cornwall Ontario near Messena, New York	298,800	132	349,800 (1973)	352,000 (1976)	353,000	121	378,000	8
05330000	Minnesota River near Jordan, Minnesota	16,200	58	24,850 (1991)	44,800 (1984)	40,790	613	88,200	25
05331000	Mississippi River at St. Paul, Minnesota	36,800	100	56,530 (1908)	78,400 (1957)	57,050	294	104,000	26
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	80	24,630 (1943)	56,800 (1943)	27,400	278	56,500	25
05435500	Pecatonica River at Freeport, Illinois	1,326	78	2,654 (1974)	4,710 (1945)	3,140	372	4,080	30
05446500	Rock River near Joslin, Illinois	9,549	53	19,850 (1974)	28,900 (1974)	22,290	330	35,700	11
05464500	Cedar River at Cedar Rapids, Iowa	6,510	90	23,420 (1947)	53,300 (1947)	26,260	482	44,100	24
05480500	Des Moines River at Fort Dodge, Iowa	4,190	60	15,440 (1984)	34,000 (1954)	15,980	770	22,100	30

floods on the Minnesota River and its tributaries, on the St. Croix River, and on the Mississippi River below its confluence with the Minnesota River in Minneapolis and St. Paul. At station Minnesota River at Mankato, a new peak of record was measured at 30.1 feet on June 21, 1993. The previous maximum stage known was 29.9 feet, on April 26, 1881, determined from floodmarks. The new peak stage occurred at a lower discharge than the 1881 flood because the river was constricted by flood walls built to protect the City of Mankato after the 1965 flood. At station Minnesota River at Jordan, the measured discharge was 91,490 cfs at a stage of 33.44 feet. This is the second highest peak discharge in 59 years of record. The June 1993 monthly-mean discharge of 40,790 cfs is the highest June monthly-mean discharge recorded (see table on page 3). A new record mean-daily discharge for June was recorded on June 25. It was 88,200 cfs, more than double the previous record mean-daily discharge for June, 40,200 cfs recorded in 1957. At station Mississippi River at St. Paul, the peak stage occurred June 26 with a discharge of 104,000 cfs (see table on page 3). This is the 5th highest peak discharge in 102 years of record. The June 1993 monthly-mean discharge of 57,050 cfs exceeded the previous record of 56,530 cfs for June 1908. The highest mean-daily discharge of 104,000 cfs exceeded the previous record for June, which was 78,400 cfs in 1957. And at station Mississippi River at Prescott, the discharge of 120,800 cfs, measured at the stage of 36.30 feet (close to the peak stage), was the 5th highest peak discharge in 65 years of record. The greatest peak discharge at this station is 228,000 cfs in spring 1965.

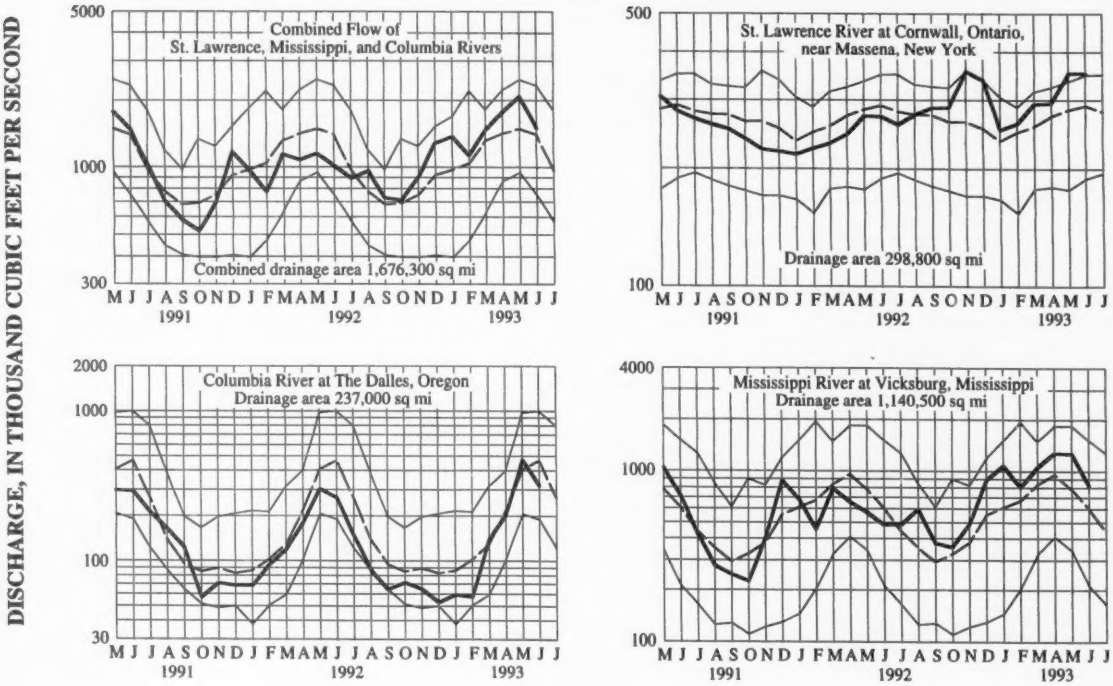
The broad, flat crest on the Mississippi River reached northeastern Iowa by the end of June. The Mississippi was closed to all barge traffic on June 28 between St. Paul and St. Louis, Missouri. The combined flow of the three largest rivers in the lower 48 States—the Mississippi, St. Lawrence, and Columbia Rivers—continued above average in June (hydrographs on page 4). Ten new extremes—all maximums—occurred during June. Hydrographs for seven of the streamflow stations at which these extremes occurred are on page 5.

The June rainfall also caused near-record reservoir levels throughout the State of Iowa. In northwestern Iowa, the Spirit Lake pool elevation reached the 100-year recurrence level. In the central part of the State, a record pool elevation of 889.36 feet was established on June 14 in Saylorville Reservoir. In east-central Iowa, the water level in Coralville Reservoir reached within 0.5 foot of the top of the emergency spillway, an elevation that has not been exceeded since the dam was completed in 1957.

Mean June elevations at the four master gages on the Great Lakes (National Ocean Service provisional data) remained in the normal range on Lakes Superior and Huron and in the above-normal range on Lakes Erie and Ontario. Levels fell from those for May on Lake Ontario and rose from those for May on Lake Huron.

HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period 1961-90. Heavy line indicates mean for current period.



Provisional data; subject to revision

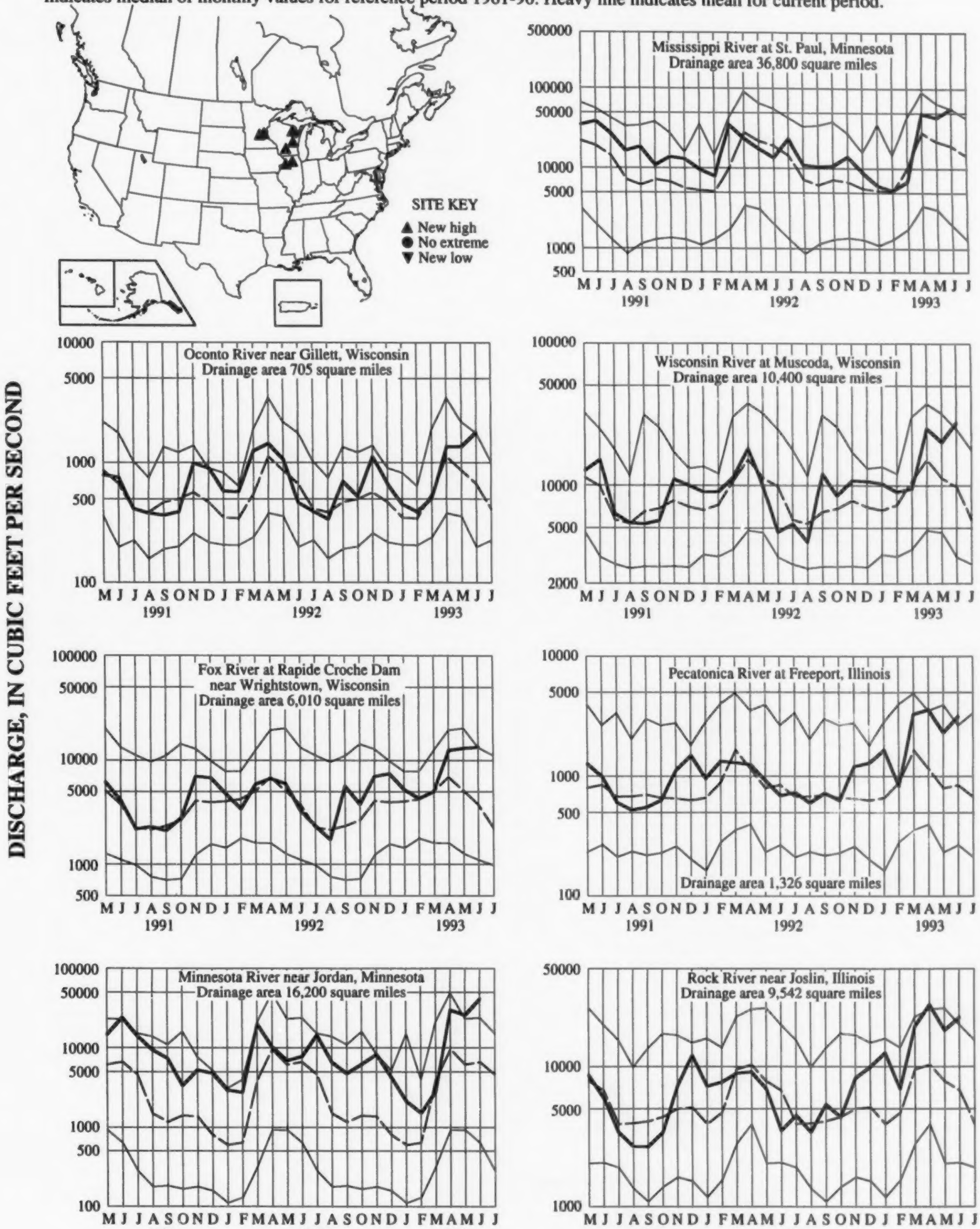
DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JUNE 1993 AT DOWNSTREAM SITES ON THREE LARGE RIVERS

Station number	Station name	June data of following calendar years	Stream discharge during month	Dissolved-solids concentration [1]		Dissolved-solids discharge [1]			Water temperature [2]		
			Mean (ft³/s)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean (°C)	Minimum (°C)	Maximum (°C)
01463500	Delaware River at Trenton, New Jersey, (Morrisville, Pennsylvania)	1993	4,596	124	138	1,630	1,232	2,361	24.0	18.5	27.5
		1945-92	9,720	60	143	[3]2,702	495	22,100	[3]22.5	13.5	34.0
		(Extreme yr)		(1945)	(1965)		(1965)	(1973)			
			[4]7,364								
07289000	Mississippi River at Vicksburg, Mississippi	1993	824,100	251	288	596,200	508,590	698,800	25.0	23.0	28.0
		1976-92	657,600	176	330	310,400	34,400	837,000	21.0	17.0	31.0
		(Extreme yr)		(1981)	(1988)		(1978)	(1984)			
			[4]599,200								
06934500	Missouri River at Hermann, Missouri. (60 miles west of St. Louis, Missouri)	1993	165,800	282	378	145,700	108,000	227,000	24.5	22.0	27.0
		1976-92	112,700	207	499	101,700	44,000	215,000	24.5	19.0	29.5
		(Extreme yr)		(1977)	(1988)		(1977)	(1984)			
			[4]107,100								

[1]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[2]To convert °C to °F: [(1.8 x °C) + 32] = °F.
[3]Mean for 8-year period (1983-91).
[4]Median of monthly values for 30-year reference period, water years 1961-90, for comparison with data for current month.

MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period 1961-90. Heavy line indicates mean for current period.



Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING JUNE 1993

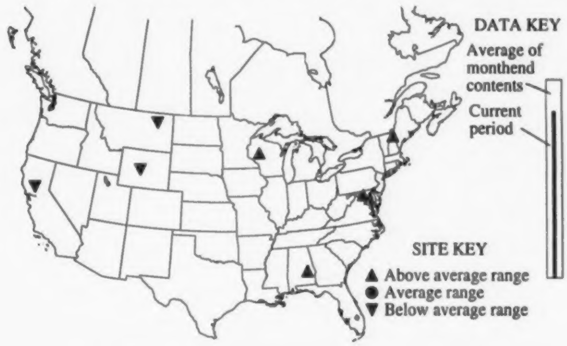
Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1991 (cubic feet per second)	June 1993: Monthly mean discharge (cubic feet per second)	June 1993: Percent of median monthly discharge 1961–90	June 1993: Change in discharge from previous month (percent)	June 1993: Discharge near end of month: Cubic feet per second	June 1993: Discharge near end of month: Million gallons per day	June 1993: Discharge near end of month: Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,665	9,693	* 14,410	152	–13	9,440	6,100	30
01318500	Hudson River at Hadley, New York	1,664	2,925	2,180	99	–43	1,350	872	30
01357500	Mohawk River at Cohoes, New York	3,456	5,673	2,830	107	–23	1,800	1,160	30
01463500	Delaware River at Trenton, New Jersey	6,780	11,660	† 4,596	62	–59	4,470	2,890	30
01570500	Susquehanna River at Harrisburg, Pennsylvania	24,100	34,200	† 11,460	56	–69	...	...	...
01646500	Potomac River near Washington, District of Columbia	11,560	[1]11,070	† [1]5,590	74	–58	...	...	...
02105500	Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina.	4,852	4,933	...	...	...	...	...	...
02131000	Pee Dee River at Peedee, South Carolina	8,830	9,903	† 5,470	69	–53	4,630	2,990	30
02226000	Altamaha River at Doctortown, Georgia	13,600	13,570	† 5,747	77	–42	4,350	2,810	30
02320500	Suwannee River at Branford, Florida	7,880	7,038	3,990	77	–36	3,570	2,310	30
02358000	Apalachicola River at Chattahoochee, Florida	17,200	22,137	† 12,500	73	–37	10,100	6,530	30
02467000	Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama.	15,385	23,700	6,695	76	–76	18,600	12,000	30
02489500	Pearl River near Bogalusa, Louisiana	6,573	10,102	5,295	117	–48	14,900	9,630	30
03049500	Allegheny River at Natrona, Pennsylvania	11,410	[1]19,690	[1]8,600	75	–31	4,500	2,910	28
03085000	Monongahela River at Braddock, Pennsylvania	7,337	[1]12,540	† [1]4,030	58	–32	2,150	1,390	28
03193000	Kanawha River at Kanawha Falls, West Virginia	8,367	12,550	6,489	88	–45	3,280	2,120	29
03234500	Scioto River at Higby, Ohio	5,131	4,654	2,414	69	–36	6,700	4,330	30
03294500	Ohio River at Louisville, Kentucky[2]	91,170	115,900	85,800	126	–18	54,700	35,400	30
03377500	Wabash River at Mount Carmel, Illinois	28,635	27,880	28,000	134	–30	23,000	14,900	30
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin[2]	6,010	4,248	* 13,300	355	2	14,500	9,380	30
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, New York[3]	298,800	245,300	* 353,000	122	0	350,000	226,000	30
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	[1]24,290	...	...	...	...	...	...
05082500	Red River of the North at Grand Forks, North Dakota	30,100	2,565	4,350	95	36	5,920	3,830	30
05133500	Rainy River at Manitou Rapids, Minnesota	19,400	9,036	13,800	56	1	13,800	8,920	30
05330000	Minnesota River near Jordan, Minnesota	16,200	7,062	* 40,790	614	59	60,000	39,000	30
05331000	Mississippi River at St. Paul, Minnesota	36,800	[1]15,890	* [1]57,050	294	31	95,700	61,800	30
05365500	Chippewa River at Chippewa Falls, Wisconsin	5,650	5,072	* 17,600	402	91	15,300	9,890	29
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	8,666	* 27,400	278	36	22,300	14,400	30
05446500	Rock River near Joslin, Illinois	9,549	6,161	* 22,290	331	23	23,000	14,900	30
05474500	Mississippi River at Keokuk, Iowa	119,000	64,070	* 214,600	244	–1	345,000	223,000	30
06214500	Yellowstone River at Billings, Montana	11,795	6,965	23,370	81	18	19,900	12,900	30
06934500	Missouri River at Hermann, Missouri	524,200	76,940	* 165,800	155	–11	157,000	102,000	30
07289000	Mississippi River at Vicksburg, Mississippi[4]	1,140,500	583,000	824,100	138	–34	739,000	478,000	28
07331000	Washita River near Dickson, Oklahoma	7,202	1,584	* 5,023	268	–75	4,400	2,840	29
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico.	9,730	757	2,433	254	–7	1,850	1,200	30
09315000	Green River at Green River, Utah	44,850	6,292	16,540	110	14	...	...	...
11425500	Sacramento River at Verona, California	21,251	18,810	* 26,410	249	40	...	...	...
13269000	Snake River at Weiser, Idaho	69,200	18,220	26,300	112	3	12,500	8,080	30
13317000	Salmon River at White Bird, Idaho	13,550	11,160	37,100	90	–5	22,100	14,300	30
13342500	Clearwater River at Spalding, Idaho	9,570	15,290	† 26,000	72	–50	18,800	12,200	30
14105700	Columbia River at The Dalles, Oregon[5]	237,000	[1]192,200	† [1]320,100	69	–32	186,000	120,000	30
14191000	Willamette River at Salem, Oregon	7,280	[1]23,400	* [1]28,270	241	–15	11,400	7,370	30
15515500	Tanana River at Nenana, Alaska	25,600	24,200	...	...	...	...	...	...
08MF005	Fraser River at Hope, British Columbia	83,800	95,720	174,100	71	–13	...	...	...

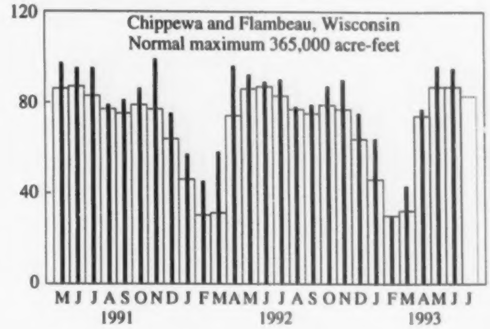
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

* Above-normal range
† Below-normal range

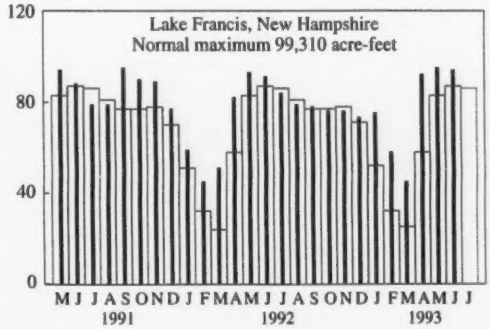
USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JUNE 1993

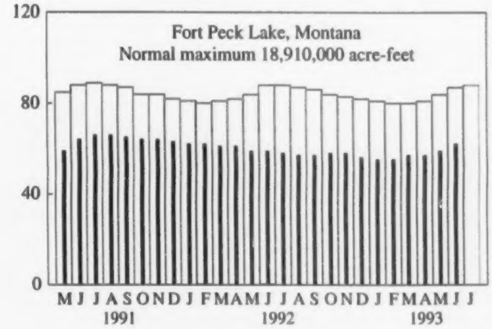
[Contents are expressed in percent of reservoir (system) capacity. The usable capacity of each reservoir (system) is shown in the column headed "Normal maximum" in the table Usable contents of selected reservoir systems.]

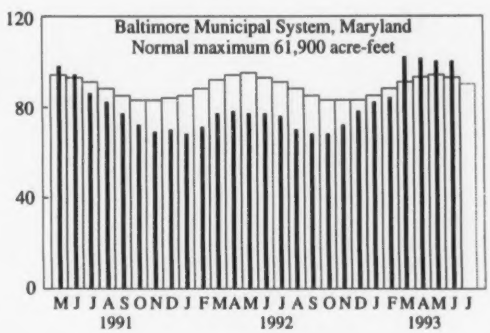


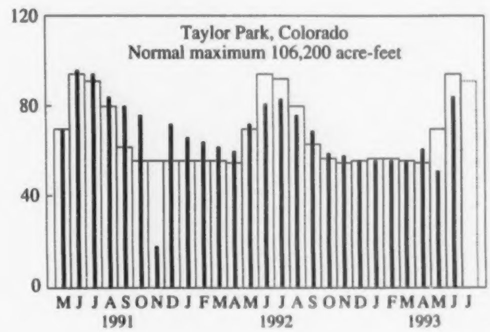


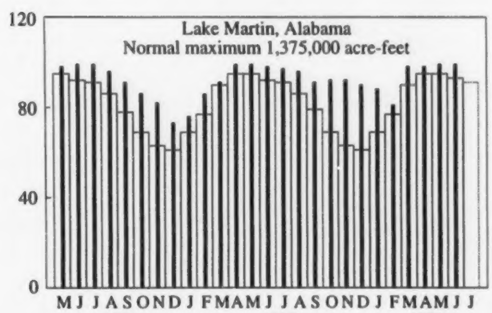
PERCENT OF NORMAL MAXIMUM

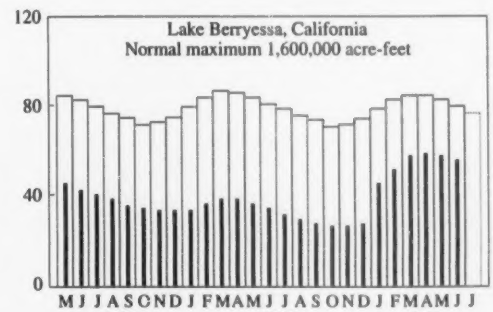












USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS NEAR END OF JUNE 1993

[Contents are expressed in percent of reservoir or reservoir system capacity. The usable capacity of each reservoir or reservoir system is shown in the column headed "Normal maximum"]

Reservoir or reservoir system Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum				
	End of June 1993	End of June 1992	Average for end of June	End of May 1993	Normal maximum (acre-feet)[1]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook reservoirs (P)	† 64	51	71	70	[2]226,300
QUEBEC					
Allard (P)	88	76	83	57	280,600
Gouin (P)	* 78	67	68	73	6,954,000
MAINE					
Seven reservoir systems (MP)	* 95	92	87	89	4,146,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	92	87	81	94	76,450
Lake Francis (FPR)	* 94	91	87	95	99,310
Lake Winnipesaukee (PR)	† 84	94	96	87	165,700
VERMONT					
Harriman (P)	83	85	83	83	116,200
Somerset (P)	85	87	86	84	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	† 83	97	88	87	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	* 98	95	92	97	786,700
Indian Lake (FMP)	98	96	100	95	103,300
New York City reservoir system (MW)	† 89	92	96	96	1,680,000
NEW JERSEY					
Wanaque (M)	88	95	89	96	85,100
PENNSYLVANIA					
Allegheny (FPR)	49	47	49	49	1,180,000
Pymatuning (FMR)	98	97	98	99	188,000
Raystown Lake (FR)	68	68	64	68	761,900
Lake Wallenpaupack (PR)	80	83	85	83	157,800
MARYLAND					
Baltimore Municipal System (M)	* 100	77	93	100	61,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	94	98	92	99	288,800
Narrows (Badin Lake) (P)	93	93	97	96	128,900
High Rock Lake (P)	* 89	87	80	83	234,800
SOUTH CAROLINA					
Lake Murray (P)	* 91	93	82	94	1,614,000
Lake Marion and Lake Moultrie (P)	* 84	90	76	89	1,777,000
SOUTH CAROLINA-GEORGIA					
Strom Thurmond Lake (FP)	73	74	72	82	1,730,000
GEORGIA					
Burton Lake (PR)	97	98	95	98	104,000
Sinclair (MPR)	89	90	90	93	214,000
Lake Sidney Lanier (FMPR)	62	64	64	65	1,686,000
ALABAMA					
Lake Martin (P)	* 99	98	93	99	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	* 70	71	62	75	2,293,000
Douglas Lake (FPR)	* 78	82	69	82	1,395,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	* 88	90	81	92	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	* 82	87	70	88	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	* 91	94	82	94	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	* 95	89	87	96	365,000
Wisconsin River (21 reservoirs) (PR)	* 92	75	81	85	399,000
MINNESOTA					
Mississippi River Headwater System (FMR)	* 48	38	40	44	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	† 69	63	87	63	22,700,000
SOUTH DAKOTA					
Angostura (I)	* 92	76	85	91	130,770
Belle Fourche (I)	* 77	31	71	56	185,200
Lake Francis Case (FIP)	83	78	86	80	4,589,000
Lake Oahe (FIP)	* 77	64	64	75	22,240,000
Lake Sharpe (FIP)	101	102	101	102	1,697,000
Lewis and Clark Lake (FIP)	† 88	88	94	88	432,000
NEBRASKA					
Lake McConaughy (IP)	† 68	58	80	67	1,948,000
OKLAHOMA					
Eufaula Lake (FPR)	* 110	107	98	144	2,378,000
Keystone Lake (FPR)	* 127	129	105	208	661,000
Tenkiller Ferry Lake (FPR)	* 117	111	103	150	628,200
Lake Altus (FIMR)	* 100	102	72	100	133,000
Lake O'The Cherokees (FPR)	* 107	100	96	122	1,492,000
OKLAHOMA-TEXAS					
Lake Texoma (FMPRW)	103	107	102	139	2,722,000
TEXAS					
Bridgeport (IMW)	* 98	98	59	97	386,400
Canyon Lake (FMR)	* 99	103	89	99	385,600
International Amistad (FIMPW)	* 87	98	81	92	3,497,000
International Falcon (FIMPW)	* 71	105	65	60	2,668,000
Livingston (IMW)	* 106	100	93	101	1,788,000
Possum Kingdom Lake (IMPRW)	93	96	97	93	570,200
Red Bluff (P)	* 40	50	28	42	307,000
Toledo Bend (P)	103	98	93	95	4,472,000
Twin Buttes (FIM)	* 72	83	37	75	177,800
Lake Kemp (IMW)	99	99	94	103	268,000
Lake Meredith (FMW)	38	43	38	38	796,900
Lake Travis (FIMPRW)	* 98	102	83	97	1,144,000
MONTANA					
Canyon Ferry Lake (FIMPR)	96	75	93	89	2,043,000
Fort Peck Lake (FPR)	† 62	59	87	59	18,910,000
Hungry Horse (FIPR)	† 61	76	93	49	3,451,000
WASHINGTON					
Ross (PR)	* 97	94	91	74	1,052,000
Franklin D. Roosevelt Lake (IP)	96	94	99	98	5,022,000
Lake Chelan (PR)	99	97	96	91	676,100
Lake Cushman (PR)	102	101	98	101	359,500
Lake Merwin (P)	101	101	105	105	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	* 92	25	84	81	1,235,000
Coeur d'Alene Lake (P)	* 97	98	86	96	238,500
Pend Oreille Lake (FP)	99	98	98	90	1,561,000
IDAHO-WYOMING					
Upper Snake River (8 reservoirs) (MP)	* 97	51	83	89	4,401,000
WYOMING					
Boysen (FIP)	* 100	72	88	85	802,000
Buffalo Bill (IP)	* 116	95	101	89	646,600
Keyhole (F)	† 35	13	48	26	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey reservoirs (I)	† 58	45	67	45	3,056,000
COLORADO					
John Martin (FIR)	25	9	24	20	364,400
Taylor Park (IR)	† 84	81	94	51	106,200
Colorado-Big Thompson Project (I)	* 82	69	76	63	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa reservoirs (IFPR)	80	66	80	71	31,620,000
UTAH-IDAHO					
Bear Lake (IPR)	† 38	27	70	30	1,421,000
CALIFORNIA					
Folsom Lake (FIMPR)	* 96	51	85	95	1,000,000
Hetch Hetchy (MP)	* 90	70	83	60	360,400
Lake Isabella (FIR)	* 72	26	50	59	568,100
Pine Flat Lake (FIR)	* 90	20	67	75	1,001,000
Clair Engle Lake (Lewiston) (FP)	84	43	86	68	2,438,000
Lake Almanor (P)	* 104	84	70	93	1,036,000
Lake Berryessa (FIMRW)	† 56	35	80	58	1,600,000
Millerton Lake (FI)	* 1009	60	81	85	503,200
Shasta Lake (FIPR)	* 100	56	84	100	4,377,000
CALIFORNIA-NEVADA					
Lake Tahoe (IMPRW)	† 9	0	71	0	744,600
NEVADA					
Rye Patch (I)	† 30	0	61	16	194,300
ARIZONA-NEVADA					
Lake Mead and Lake Mohave (FIMP)	* 82	75	76	83	27,970,000
ARIZONA					
San Carlos (IP)	* 69	73	26	76	935,100
Salt and Verde River System (IMPR)	* 77	80	51	84	2,019,100
NEW MEXICO					
Conchas (FIR)	85	96	83	86	315,700
Elephant Butte and Caballo (FIPR)	* 91	93	43	87	2,394,000

[1] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

[2] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

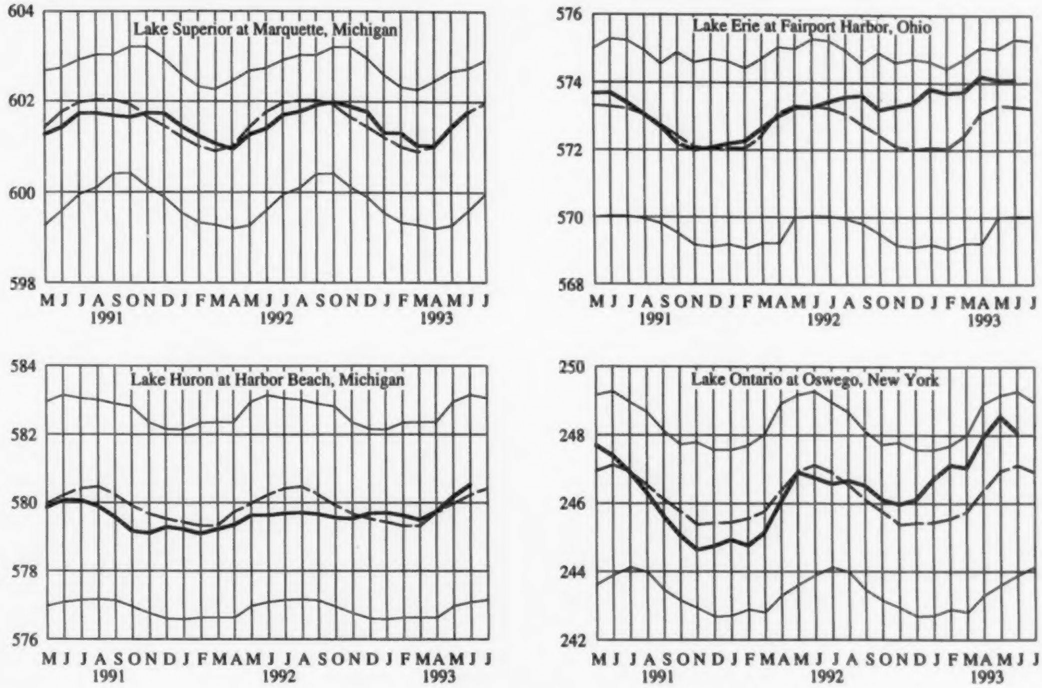
* Above-average range

† Below-average range

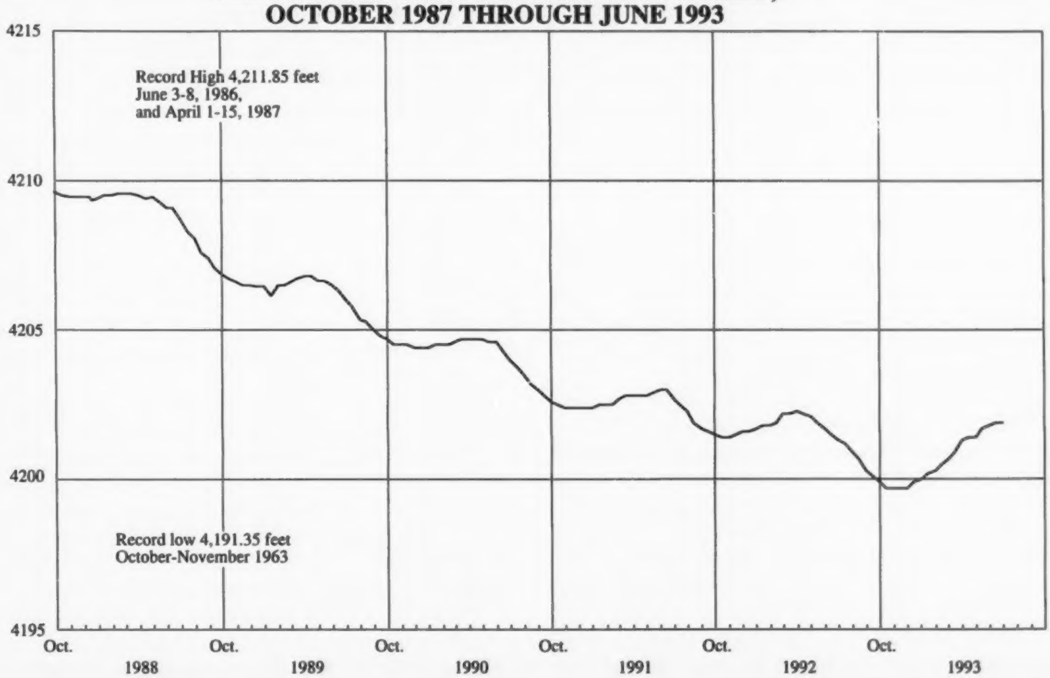
GREAT LAKES ELEVATIONS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period 1961-90. Heavy line indicates mean for current period. Data from National Ocean Service.

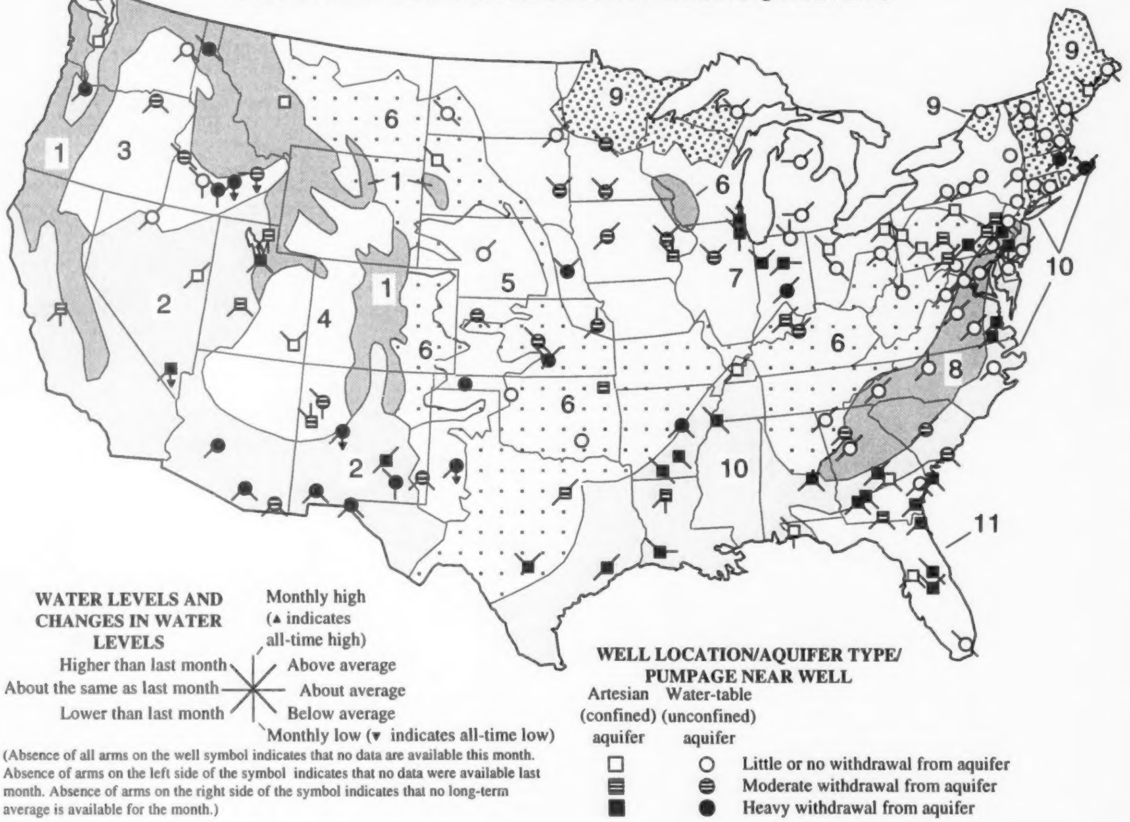
ELEVATION, IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929



FLUCTUATIONS OF THE GREAT SALT LAKE, OCTOBER 1987 THROUGH JUNE 1993



GROUND-WATER CONDITIONS DURING JUNE 1993



New extremes occurred at 24 ground-water index stations during June—17 low (including 5 all-time), and 7 highs (including 1 all-time)—compared with 30 new extremes last month. Graphs showing water levels in seven wells for the past 26 months are on page 13. Two of the graphs are for wells in the Colorado Plateau and Wyoming Basin region, a monthly low and a monthly high in New Mexico. Two graphs are for wells in the Glaciated Central region, a monthly high in Iowa and average in South Dakota. The other graphs are for wells in the Alluvial Basins region (monthly low in Utah), the Atlantic and Gulf Coastal Plain region (monthly low in New Jersey), and the Southeast Coastal Plain region (Florida).

Ground-water levels in the Western Mountain Ranges region were below last month's levels in Washington and above last month's in Idaho, and below long-term average throughout the region.

In the Alluvial Basins region, ground-water levels were mixed with respect to last month's in New Mexico and below last month's levels elsewhere. Levels were below long-term average except in the Oregon well, one well in New Mexico, and two wells in Nevada that were above average. All-time lows occurred in the valley-fill aquifer well near Las Vegas, Nevada, and in the basin-fill aquifer well at Albuquerque, New Mexico. June lows occurred in wells in California, New Mexico, and Utah. A June high occurred in the Oregon well.

In the Columbia Lava Plateau region, water levels were mixed with respect to last month's in Idaho and were below last month's in Oregon; water levels were below long-term average throughout the region. The level in the Snake River Plain aquifer well near Atomic City, Idaho, tied the all-time low set in May 1993 and the level in the Snake River Plain aquifer well near Rupert, Idaho, tied the all-time low set in August 1992. Monthly lows occurred in the Snake River Plain aquifer wells at Gooding, Idaho (ninth consecutive month and includes five all-time lows) and near Eden, Idaho (ninth consecutive month and includes three all-time lows). The Oregon well did not register a monthly low for the first time this year.

Ground-water levels in the Colorado Plateau and Wyoming Basin region were above last month's levels in Utah and New Mexico. Levels were above long-term average in Utah and mixed with respect to average in New Mexico. A monthly low occurred in the Westwater Canyon aquifer well near Grants-Bluewater, New Mexico (for the sixth consecutive month), and a monthly high occurred in the San Andres-Yeso aquifer well at Bluewater, New Mexico (for the first time this year).

In the High Plains region, ground-water levels were below last month's in Kansas, New Mexico, and Texas. Levels were below long-term average except in Nebraska. An all-time low occurred in the Ogallala aquifer well near Lubbock, Texas.

Ground-water levels in the Nonglaciated Central region

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES–JUNE 1993

GROUND–WATER REGION Aquifer and Location	Aquifer type and local aquifer pumpage	Depth of well in feet	Water level in feet below land–surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
WESTERN MOUNTAIN RANGES (1)								
Rathdrum Prairie aquifer near Athol, northern Idaho	●	485	467.1	–7.3	1.4	–3.8	1929	
ALLUVIAL BASINS (2)								
Alluvial valley–fill aquifer in Steptoe Valley, Nevada	□	122	8.93	3.05	–.64	–.04	1949	
Valley–fill aquifer, Elfrida area near Douglas, Arizona	⊜	124	100.31	–15.32	–.14	.84	1947	
Hueco bolson aquifer at El Paso, Texas	●	640	274.23	–18.23	–.80	–2.52	1964	
COLUMBIA LAVA PLATEAU (3)								
Snake River Plain aquifer near Eden, Idaho	●	137	128.1	–4.1	5.6	–2.9	1962	June low
Columbia River basalts aquifer at Pendleton, Oregon	⊜	1,501	227.45	–33.54	–1.15	.77	1965	
COLORADO PLATEAU AND WYOMING BASIN (4)								
Dakota aquifer near Blanding, Utah	□	140	44.14	2.03	2.21	6.02	1960	
HIGH PLAINS (5)								
Ogallala aquifer near Colby, Kansas	⊜	175	130.75	–11.28	–.23	.68	1947	
Southern High Plains aquifer at Lovington, New Mexico	⊜	212	58.25	–3.52	–.22	.58	1971	
NONGLACIATED CENTRAL REGION (6)								
Sentinel Butte aquifer near Dickinson, North Dakota	○	160	21.15	–3.85	.52	.88	1968	
Sand and gravel Pleistocene aquifer near Valley Center, Kansas	●	54	15.92	1.15	.32	3.84	1937	
Glacial outwash aquifer near Louisville, Kentucky	⊜	94	18.15	5.73	.04	.25	1945	
Upper Pennsylvanian aquifer in the Central Appalachians Plateau near Glenville, West Virginia	○	25	10.84	5.87	.20	.71	1953	June high
GLACIATED CENTRAL REGION (7)								
Fluvial sand and gravel aquifer, Platte River Valley, near Ashland, Nebraska	●	12	1.53	2.99	.47	4.59	1933	
Sheyenne Delta aquifer near Wyndmere, North Dakota	○	40	2.93	1.14	–.20	1.05	1963	
Pleistocene (glacial drift) aquifer at Princeton, Illinois	⊜	29	6.12	2.98	.12	.78	1942	
Shallow drift aquifer near Roscommon, Michigan	○	14	3.70	.52	–.01	.15	1934	
Silurian–Devonian carbonate aquifer near Dola, Ohio	□	51	6.44	.37	.06	–.06	1954	
PIEDMONT AND BLUE RIDGE (8)								
Water–table aquifer in Petersburg Granite, southeastern Piedmont at Colonial Heights, Virginia	○	100	14.96	.44	–1.43	.44	1939	
Weathered granite aquifer near Mocksville, North Carolina	○	31	13.52	3.93	–.94	1.96	1981	June high
Surficial aquifer at Griffin, Georgia	○	30	14.35	.47	–2.27	2.10	1943	
NORTHEAST AND SUPERIOR UPLANDS (9)								
Pleistocene glacial outwash aquifer, at Camp Ripley, near Little Falls, Minnesota	⊜	59	14.37	–.60	.98	.96	1949	
Glacial outwash sand aquifer at Oxford, Maine	○	39	8.37	–.40	–.59	–.13	1980	
Shallow sand aquifer (glacial deposits) at Acton, Massachusetts	●	34	18.22	.07	–.63	.65	1965	
Stratified drift aquifer near Morristown, Vermont	○	50	18.99	–.17	–.45	.73	1966	
ATLANTIC AND GULF COASTAL PLAIN (10)								
Columbia deposits aquifer near Camden, Delaware	○	11	6.31	.26	–.70	1.34	1950	
Memphis sand aquifer near Memphis, Tennessee	■	384	107.55	–16.03	.10	.03	1940	
Eutaw aquifer at Montgomery, Alabama	■	270	24.7	–2.0	–1.9	1.7	1952	
Evangeline aquifer at Houston, Texas	■	1,152	275.22	23.17	–.06	7.30	1978	
SOUTHEAST COASTAL PLAIN (11)								
Upper Floridan aquifer on Cockspur Island near Savannah, Georgia	■	348	35.06	–6.31	–4.47	–.84	1956	
Upper Floridan aquifer at Jacksonville, Florida	■	905	–21.2	–5.4	–1.8	–.2	1930	
Biscayne aquifer near Homestead, Florida	○	20	6.61	–.85	.83	–.84	1932	

were generally above last month's levels except in Texas, where they were mixed with respect to last month's levels, and in Georgia, Maryland, Pennsylvania, and Virginia where they were below last month's levels. Water levels were generally above long-term average in Texas, Georgia, Kentucky, Virginia, and West Virginia, and below average elsewhere except in Kansas and Pennsylvania where they were mixed. A monthly high occurred in the Upper Pennsylvanian aquifer well near Glenville, West Virginia.

Ground-water levels in the Glaciated Central region were generally below last month's in Kansas, New York, and North Dakota, mixed with respect to last month's levels in Iowa, Ohio, and Pennsylvania, and generally above last month's levels elsewhere. Water levels were generally below long-term average in Pennsylvania, mixed with respect to long-term averages in Illinois, Ohio, and above average elsewhere in the region. An all-time high occurred in the Ironton-Galesville aquifer well at Illinois Beach State Park, Illinois (for the seventh consecutive month). Monthly highs occurred in wells in Iowa and Kansas for the second time this year. A monthly low occurred in the Lower Mount Simon aquifer well at Illinois Beach State Park, Illinois (for the ninth consecutive month). Indiana data were not available.

The Piedmont and Blue Ridge region ground-water levels

NEW EXTREMES DURING JUNE AT GROUND–WATER INDEX STATIONS

WRD Station Identification Number	GROUND–WATER REGION Aquifer and Location	Aquifer type and local aquifer pumpage	Depth of well	Years of record	End–of–month water level in feet below land surface datum: Previous June Record: Average	Extreme (year)	June 1993
	LOW WATER LEVELS						
	ALLUVIAL BASINS (2)						
324340104231701	Roswell Basin shallow aquifer at Dayton, New Mexico	●	250	42	93.18	123.08 (1992)	123.13
351051106395301	Basin–fill aquifer at Albuquerque, New Mexico	●	980	10	35.33	38.41 (1992)	[1]39.16
361611115151301	Valley–fill aquifer near Las Vegas, Nevada	■	905	47	38.13	104.14 (1992)	[1]120.28
382444121123301	Mehrten aquifer near Wilton, California	▤	300	7	136.33	141.50 (1992)	141.69
414501111520001	Basin–fill aquifer near Logan, Utah	▥	43	52	–17.7	–12.6 (1989)	–10.7
	COLUMBIA LAVA PLATEAU (3)						
423659114111601	Snake River Plain aquifer near Eden, Idaho	●	208	30	124.0	127.6 (1982)	128.1
424053113412801	Snake River Plain aquifer near Rupert, Idaho	●	194	42	153.4	163.3 (1991)	[1]166.7
425635114382302	Snake River Plain aquifer at Gooding, Idaho	○	165	21	136.5	150.0 (1992)	155.2
432700112470801	Snake River Plain aquifer near Atomic City, Idaho	⊜	636	44	585.2	589.1 (1992)	[1]589.9
	COLORADO PLATEAU AND WYOMING BASIN (4)						
352023107473201	Westwater Canyon aquifer near Grants–Bluewater, New Mexico	⊜	155	37	75.18	79.79 (1992)	81.65
	HIGH PLAINS (5)						
341010102240801	Ogallala aquifer near Lubbock, Texas	●	202	42	59.65	94.00 (1992)	[1]96.04
	GLACIATED CENTRAL REGION (7)						
422803087475302	Lower Mount Simon aquifer at Illinois Beach State Park, Illinois	■	2,264	4	203.05	206.10 (1992)	206.59
	NORTHEAST AND SUPERIOR UPLANDS (9)						
413254072335501	Pleistocene sand and gravel aquifer at Middletown, Connecticut	○	28	37	20.34	21.30 (1991)	21.40
	ATLANTIC AND GULF COASTAL PLAIN (10)						
303108087162301	Sand and gravel aquifer at Ensley, Florida	□	239	53	74.51	83.67 (1992)	84.65
321357092341701	Sparta aquifer near Ruston, Louisiana	▤	763	49	224.35	237.49 (1992)	238.94
372506076511703	Upper Potomac aquifer near Toana, Virginia	■	401	7	159.27	163.90 (1992)	164.50
395524074502501	Upper Potomac–Raritan–Magothy aquifer system near Medford, New Jersey	■	410	16	117.93	141.07 (1991)	142.58
	HIGH WATER LEVELS						
	ALLUVIAL BASINS (2)						
452938122254801	Troutdale aquifer near Portland, Oregon	●	715	29	99.36	89.10 (1989)	87.67
	COLORADO PLATEAU AND WYOMING BASIN (4)						
351651107594501	San Andres–Yeso aquifer at Bluewater, New Mexico	▤	505	47	109.33	99.34 (1992)	98.27
	NONGLACIATED CENTRAL REGION (6)						
385604080495901	Upper Pennsylvanian aquifer near Glenville, West Virginia	○	25	39	16.71	11.55 (1992)	10.84
	GLACIATED CENTRAL REGION (7)						
390006095132301	Newman terrace deposits aquifer near Lawrence, Kansas	⊜	53	42	20.36	16.01 (1987)	15.24
422803087475304	Ironton–Galesville aquifer at Illinois Beach State Park, Illinois	■	1,203	4	232.56	230.55 (1991)	[2]223.13
414315091252002	Devonian aquifer near Morse, Iowa	▤	82	51	16.30	13.46 (1970)	11.88
	PIEDMONT AND BLUE RIDGE (8)						
355359080331701	Weathered granite aquifer near Mocksville, North Carolina	○	31	11	17.45	14.56 (1991)	13.52

[1] All–time month–end low.

[2] All–time month–end high.

were below last month's throughout the region. Levels were below long-term average in New Jersey above long-term average in Maryland, North Carolina, and Pennsylvania, and mixed with respect to average in the remainder of the region. A monthly high occurred in the weathered granite aquifer near Mocksville, North Carolina (for the eighth consecutive month).

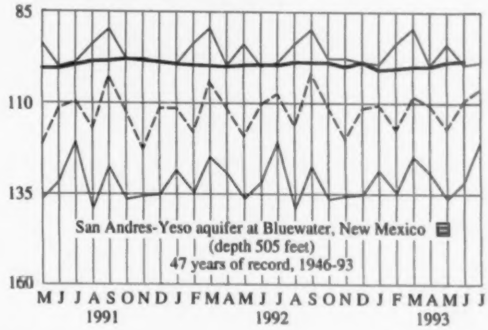
In the Northeast and Superior Uplands region, levels were generally above last month's in Michigan and Minnesota, mixed with respect to last month's levels in Maine, and below last month's levels elsewhere. Water levels were above average in Massachusetts and Michigan, mixed with respect to averages in Maine, and below average elsewhere. A monthly low occurred in the Pleistocene sand and gravel aquifer well at Middletown, Connecticut (for the first time this year).

In the Atlantic and Gulf Coastal Plain region, water levels were above last month's in Florida and Tennessee, mixed in Arkansas and Louisiana, and generally below last month's levels elsewhere. Levels were above long-term average in Delaware, Georgia, Kentucky, Massachusetts, and Texas, mixed in New Jersey and South Carolina, and below average elsewhere. For the ninth consecutive month, monthly lows occurred in wells in the Sparta aquifer near Ruston, Louisiana, the sand and gravel aquifer at Ensley, Florida, and the Upper Potomac aquifer near Toana, Virginia. A monthly low occurred in the Upper Potomac-Raritan-Magothy aquifer system well near Medford, New Jersey (for the second consecutive month).

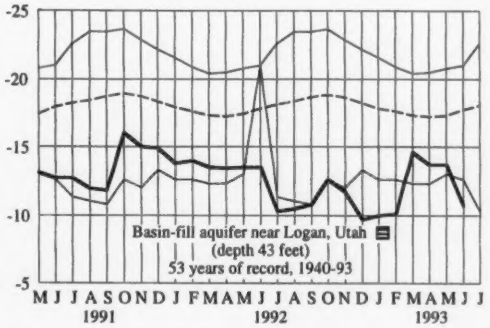
In the Southeast Coastal Plain region, water levels were generally mixed with respect to last month's in Florida, but below last month's in Georgia. Water levels were mixed with respect to long-term average throughout the region.

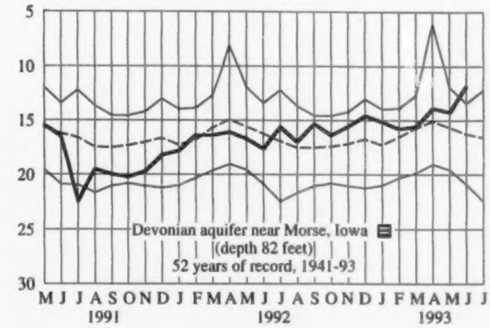
MONTHEND GROUND-WATER LEVELS IN SELECTED WELLS

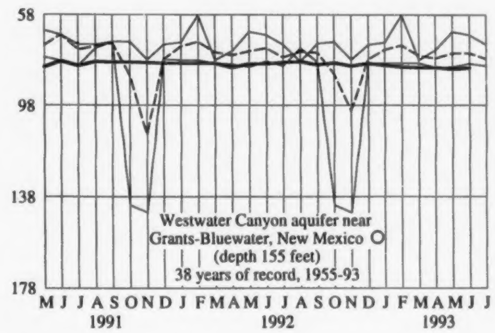
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.

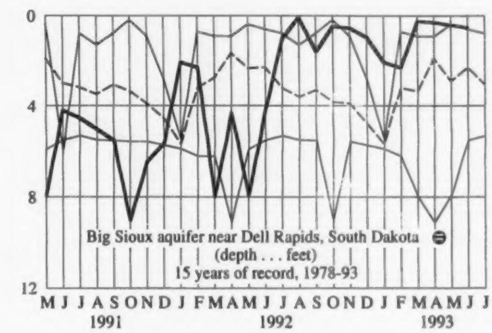


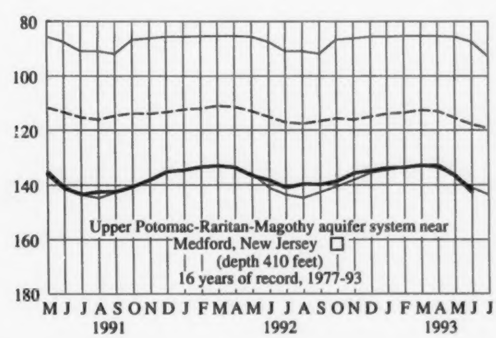
WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM

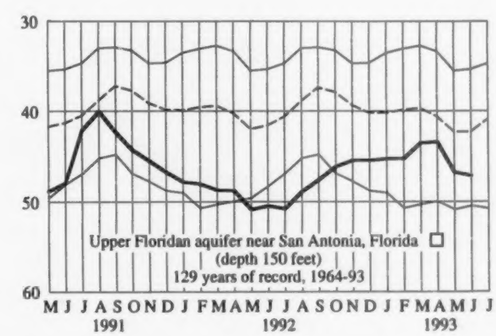




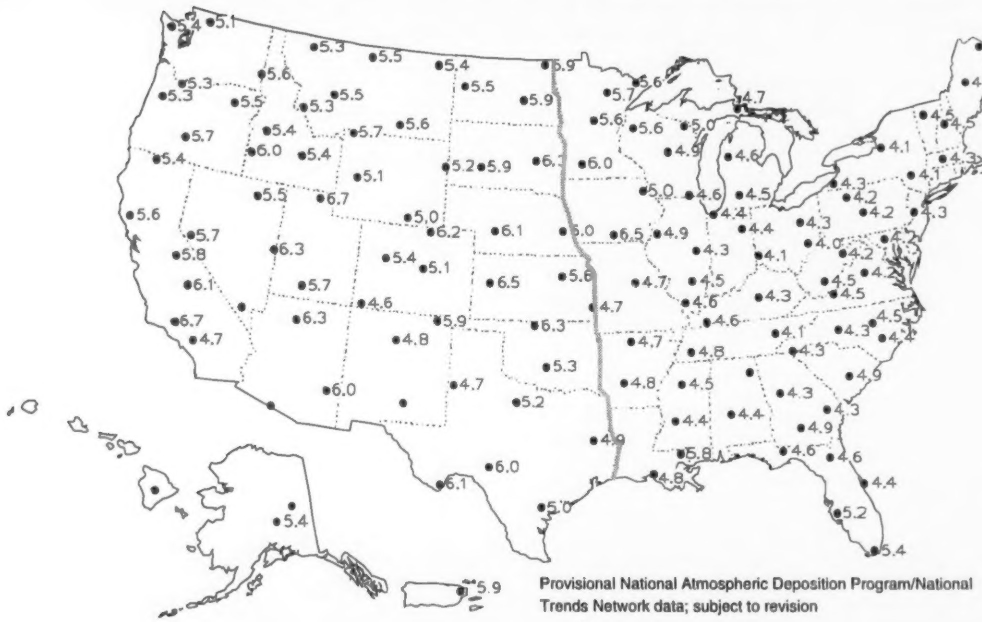








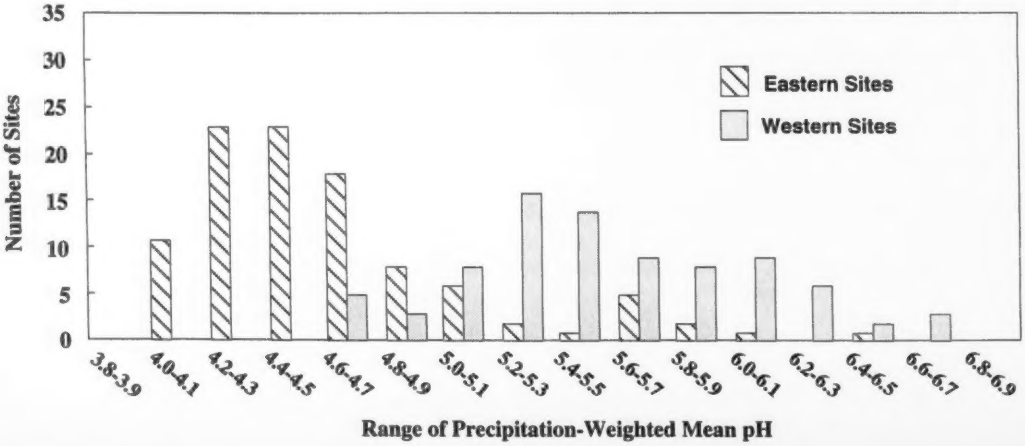
pH of Precipitation for May 24-June 20, 1993



Current pH data shown on the map (• 4.9) are precipitation-weighted means calculated from preliminary laboratory results provided by the NADP/NTN Central Analytical Laboratory at the Illinois State Water Survey and are subject to change. The 128 points (•) shown on this map represent a subset of all sites chosen to provide relatively even geographic spacing. Absence of a pH value at a site indicates either that there was no precipitation or that data for the site did not meet preliminary screening criteria for this provisional report.

A list of the approximately 200 sites comprising the total Network and additional data for the sites are available from the NADP/NTN Coordination Office, Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO 80523.

Distribution of precipitation-weighted mean pH for all NADP/NTN sites having one or more weekly samples for May 24-June 20, 1993. The East/West dividing line is at the western borders of Minnesota, Iowa, Missouri, Arkansas, and Louisiana.



NATIONAL WATER CONDITIONS

JUNE 1993

Based on reports from the Canadian and U.S. Field offices; completed March 21, 1994

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Page showing pH of precipitation data furnished by Office of Atmospheric Deposition.

The *National Water Conditions* is published monthly. Subscriptions are free on application to the U.S. Geological Survey, 419 National Center, Reston, VA 22092.

EXPLANATION OF DATA (Revised March 1994)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 186 index gaging stations—18 in Canada, 166 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1961-90. Shorter reference periods are used for one index station in Utah and both of the Puerto Rico index stations. Streamflow data presented herein are those published in the annual series of U.S. Geological Survey reports titled *Water Resources Data* (State) through the end of the 1992 water year—September 30, 1992. All other data are provisional.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by weighted averaging of the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile or median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal***. For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each observation well is compared with average level for the end of the month determined from the entire period of record for that well. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for three stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

Multiply inch-pound units	By	To obtain SI units
	Length	
inches	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet	3.048×10^{-1}	meters (m)
miles	1.609×10^{3}	kilometers (km)
	Area	
square miles	2.590×10^{0}	square kilometers (km^2)
	Volume	
acre-feet (acre-feet)	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic hectometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{-2}	cubic meters per second (m^3/s)

*U.S. G.P.O:1994-301-077:80070

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